1. If a and b are positive numbers such that a + b = 7, then $\dfrac{7-b}{a} =$

A. b-1

B. 1

C. 0

D. -1

E. a

F. Leave question unanswered.

2. If $x^2 = x + 6$ then which of the following must be true?

A. x = 6

B. x < 3

C. x > 0

D. $x^2 < x$

E. $x^2 > x$

F. Leave question unanswered.

3. The point (2,1) is the midpoint of a segment with endpoints at (−5,3) and (x,y). Calculate (x,y).

A. (-3,4)

B. (-7,2)

C. (7,1)

D. (9,-1)

E. (-10,3)

F. Leave question unanswered.

4. Solve for x: $8^{x+2} = \left(\frac{1}{4}\right)^{3-2x}$

A. x=12

B. x=1/3

C. x=5

D. x=0

E. x=12/7

F. Leave question unanswered.
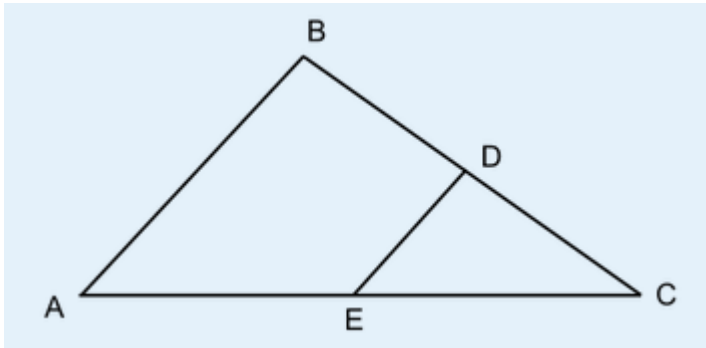
5. Factor $4x^3-16x^2+12-3x$

A. (x - 4)(4x²-3)

B. (x - 4)(4x²-1)

C. (x - 4)(4x²+3)

D. 4x²(x - 4)+3(4-x)

E. (x²- 4)(4x-3)

F. Leave question unanswered.

6. In the figure, AB is parallel to DE, AE = 14, CE = 7, and DE = 5. What is the length of AB?

A. 8

B. 10

C. 15

D. 14

E. 16

F. Leave question unanswered.

7. For some positive real number a, the first 3 terms of a geometric progression are $a-1, a+3$ and $3a+1$. What is the numerical value of the fourth term?

A. 25

B. 36

C. 32

D. 100

E. 9

F. Leave question unanswered.

8. If $(x-1)^{x^2} = 1$ and x is not equal to 1, then all the possible values of x are

A. 0

B. 2

C. -2

D. 0 և 2

E. None of the above

F. Leave question unanswered

9. If the radius of a sphere is doubled, the percent increase in volume is

A. 100

B. 200

C. 400

D. 700

E. 800

F. Leave question unanswered

10. When a natural number n is divided by 9, the remainder is x. When 2n is divided by 9, the remainder is y. Which (x, y) pair is not possible?

A. (4,8)

B. (6,3)

C. (4,0)

D. (0, 0)

E. (8, 7)

F. Leave question unanswered.

11. Given that $x = 20^\circ$, what is the value of

$$\log_5(\tan(x)) - \log_5(\sin(x)) + \log_5(\cos(x)),$$?

A. 0

B. 1/2

C. 1

D. $\log_5(2)$

E. $\log_5(5)$

F. Leave question unanswered

12. Which of the following numbers is rational?

A. The square root of 5

B. The square root of 2 divided by 2

C. The square root of 9

D. Π

E. The square root of 2

F. Leave question unanswered

13. If $5^x = 2$, which of the listed values best approximates 3^x?

A. 2.8

B. 2.3

C. 2.1

D. 1.9

E. 1.6

F. Leave question unanswered

14. If $y = 2x + 3$ and $x < 4$, which of the following represents all possible values of x?

A. y > 5

B. y < 5

C. 0 < y < 11

D. y > 11

E. y < 11

F. Leave question unanswered

15. The domain of the function $f(x) = \frac{x-4}{\sqrt{1-2x}}$ is
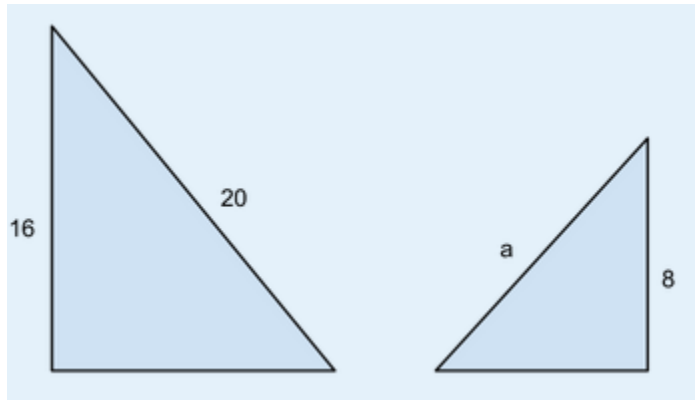
A. x ≠ 1/2

B. x ≥ 4

C. x ≠ 4

D. x < 1/2

E. x > 0

F. Leave question unanswered

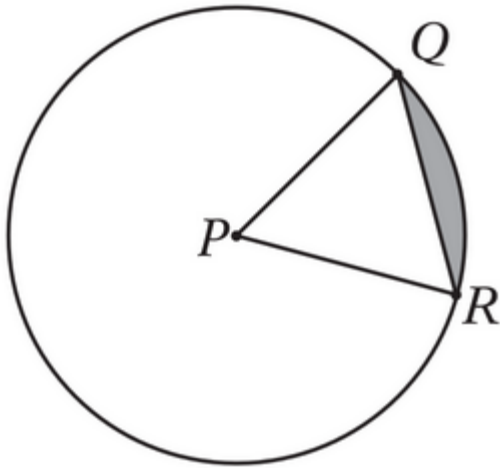16. If the two triangles in the figure are similar, find a.

A. 12

B. 6

C. 10

D. 16

E. 14

F. Leave question unanswered

17. In the figure, P is the center of the circle and PQ = QR. If triangle PQR has an area of $9\sqrt{3}$, what is the area of the shaded region?

A. $36\pi - 9\sqrt{3}$

B. $24\pi - 9\sqrt{3}$

C. $18\pi - 9\sqrt{3}$

D. $9\pi - 9\sqrt{3}$

E. $6\pi - 9\sqrt{3}$

F. Leave question unanswered

18. If $\frac{ab}{c} = d$, and a and c are doubled, what happens to the value of d?

A. The Value of d remains the same.

B. The value of d is doubled.

C. The value of d is four times greater.

D. The value of d is halved.

E. The value of d is four times smaller.

F. Leave question unanswered.

19. If $\log_r(6) = S$ and $\log_r(3) = T$, then $\log_r\left(\frac{r}{2}\right) =$

A. $\frac{1}{2}\log 2(r)$ for any r

B. $1 - S + T$

C. $1 - S - T$

D. $\log_r(2) - 1$

E. Zero if r=4

F. Leave question unanswered.

20. What is the dot product of vectors $\vec{u}$ and $\vec{v}$ if $\vec{u} = (2,3)$ and $\vec{v} = (6,-4)$.

A. -1

B. 0

C. 1

D. 2

E. -2

F. Leave question unanswered.

21. Let L be a line in some plane P and let A and B be two points on L. What is the set of points of P that are at equal distance from A and B?

A. The midpoint of the line segment AB.

B. The points on the line perpendicular to L and passing through the midpoint of line segment AB.

C. The point on line L.

D. {A, B, midpoint of AB}

E. The points along the circle centered at the midpoint of line segment AB

F. Leave question unanswered

22. In triangle ABC, BC = 5, AC = 7, and AB = 8. What is the cosine of angle C?

A. 1/7

B. 1/2

C. √3/2

D. 5/7

E. 8/7

F. Leave question unanswered

23. The solution set of $\sqrt{x+9} - 7 = 0$ is

A.   A. {40}

B.   B. {-40}

C.   C. {88}

D.   D. {-74, 74}

E.   The empty set

F.   Leave question unanswered

24. If m and n are both squares of integers, which of the following is NOT necessarily the square of an integer?

A. 9m

B. mn

C. m^2

D. 9mn

E. 9m - 9n

F. Leave question unanswered

25. Which of the following is a unit vector perpendicular to the vector $(5,12)$?

A. $\left(\sqrt{\frac{12}{13}}, -\sqrt{\frac{5}{13}}\right)$

B. $(12,-5)$

C. $\left(\frac{12}{13}, \frac{5}{13}\right)$

D. $\left(\frac{12}{13}, -\frac{5}{13}\right)$

E. $\left(-\sqrt{\frac{5}{13}}, \sqrt{\frac{12}{13}}\right)$

F. Leave question unanswered

26. If $f(x) = \frac{x^2-1}{x+3}$ and $g(f(5)) = 21$ then which of the following could be $g(t)$?

A. $3t^2 + 2t + 1$

B. $t^2 - t + 1$

C. $t^2 + 3t - 1$

D. $t^2 + 3t + 3$

E. $(t^2 + 3)/ (-1)$

F. Leave question unanswered

27. For values of x in the interval $0° \le x \le 360°$, what is the total number of solutions for x in the equation $\cos x(\cos x - 2) = 0$?

A. 1

B. 2

C. 3

D. 4

E. No solutions

F. Leave question unanswered

28. A small square is removed from a large square, reducing the area of the large square by 4%. How many times longer is the side of the large square than the side of the small square?

A. $2\sqrt{\frac{6}{5}}$

B. $\sqrt{5}$

C. 3

D. $5\sqrt{2}$

E. 5

F. Leave question unanswered

29. If $a \uparrow b$ is defined as $a \uparrow b = a + b + ab$, then for all numbers x, y, z which of the following must be true?

(I) x ↑ y = y ↑ x
(II) (x-1) ↑ (x+1) = (x ↑ x) - 1
(III) x ↑ (y+z) = (x ↑ y) + (x ↑ z)

A. I only

B. II only

C. III only

D. I and II only

30. If $xy>0$, the expression $\log(2xy)$ is equivalent to

A. 2(log x + log y)

B. 2(log x)(log y)

C. 2log x + log y

D. log2 + log x + log y

E. log x + 2log y

F. Leave question unanswered

31. Given that $f(x)=(x^5-1)(x^3+1)$, $g(x)=(x^2-1)(x^2-x+1)$, and $h(x)$ is a polynomial such that $f(x)=g(x)h(x)$, what is the value of $h(1)$?

A. 0

B. 2

C. 3

D. 5

E. undefined

F. Leave question unanswered

32. The average of 5 different integers is 33. The smallest of the 5 integers is 30. The largest of the five integers is N. How many possible values of N are there?
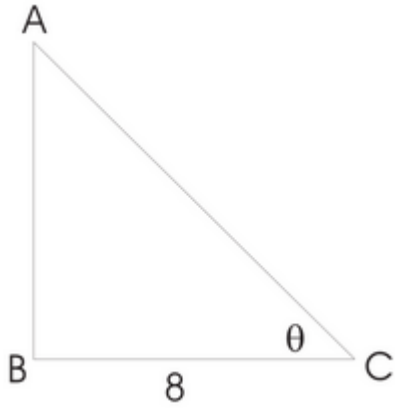
A. 3

B. 6

C. 5

D. 4

E. 7

F. Leave question unanswered

33. In the figure below, if $\cos(\theta)=0.8$ and the length of segment $BC=8$, what is the perimeter of the triangle?

A. 26

B. 16

C. 24

D. 30

E. 32

F. Leave question unanswered

34. Suppose that $log_3(x)=\frac{1}{3}$. What is the value of $\log_x(8)$?

A. $\sqrt[3]{3}$

B. $3\log_2 8$

C. $9\log_3 2$

D. $6\log_3 2$

E. $2\log_6 8$

F. Leave question unanswered

35. Find the value of x in the following equation

$$\left(1-\frac{1}{2^2}\right)\left(1-\frac{1}{3^2}\right)\left(1-\frac{1}{4^2}\right)....\left(1-\frac{1}{2011^2}\right)=\frac{x}{2\cdot2012}$$

A. 1

B. 2010

C. 2011

D. 2012

E. None of the above

F. Leave question unanswered

36. Bob and Carol and Ted and Alice are backpacking in the wilderness. Each person carries x pounds of equipment at the start of the trip. "Equipment" does not include food so the total weight of equipment (4x) is constant. During the first night, Bob sneaks 10 pounds of equipment from his pack into Carol's. Ted and Alice each sneak 7 pounds of equipment from their packs into Carol's. Later, when the other three are picking berries, Carol divides all the equipment in her pack evenly amongst the packs of her three pals. If Bob's pack now contains 54 pounds of equipment, how much did it contain originally?

A. 32 pounds

B. 35 pounds

C. 40 pounds

D. 42 pounds

E. 45 pounds

F. Leave question unanswered

37. Let two 10x15 rectangles share a common corner and overlap. The distance from the bottom right corner of one rectangle to the intersection point along the right edge of that rectangle is 9. What is the approximate area of the shaded region?
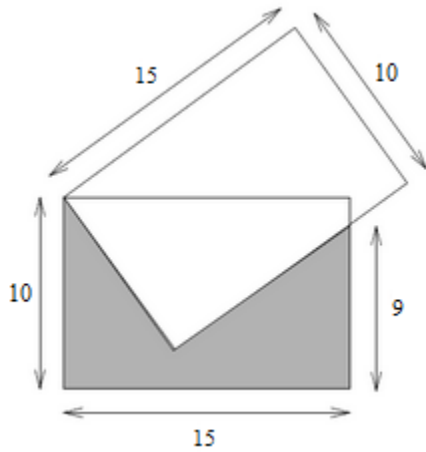
A. 45

B. 58

C. 66

D. 86

E. 84

F. Leave question unanswered Feedback

38. At a party, each person shakes hands with exactly 5 other people. There are a total of 60 handshakes. How many people are at the party?

A. 6

B. 12

C. 15

D. 24

E. 30

F. Leave question unanswered Feedback

39. Write the inverse of the function f as defined by $f(x) = 2x - 3$.

A. (x+3)/2

B. (1/2)x-3

C. -2x+3

D. 1/(2x-3)

E. (x-3)/2

F. Leave question unanswered Feedback

40. Three circles, centered at A, B, and C, are exteriorly tangent to one another. The circle with center A has radius 3. The circle with center B has radius 5. The measure of angle BAC is $\pi/3$ (in radians). What is the measure of angle ABC in radians?

A. $\pi/4$

B. arccos(11/14)

C. arccos(3/8)

D. 6

E. arccos(8/15)

F. Leave question unanswered Feedback